Technical Report 807

The Relationship of Group Cohesion to Group Performance: A Research Integration Attempt

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The Army's increasing interest in group cohesion has led to increased research effort in that area. This report describes an effort to integrate the cohesion-performance research that employed real world groups using a meta-analytic approach. Tukey's (1977) stem and leaf display was used to display the data. The median effect size (product-moment correlation coefficient) for the 14 codable studies was .36, and the unweighted mean r was .42. When study effect sizes were weighted by the number of (Continued)

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20. Abstract (Continued)

groups involved, the mean became .32. Rosenthal and Rubin's (1982) Binomial Effect Size Display (BESD) demonstrated that a correlation of .32 increases success rate (high performance) from 34 percent to 66 percent when cohesion is increased from low (below median) to high (above median). Although these findings are problematical because of the very small number of codable studies, as well as the conceptual and methodological problems associated with the cohesion-performance research, higher levels of cohesion would seem to be very desirable for real world groups such as Army units.

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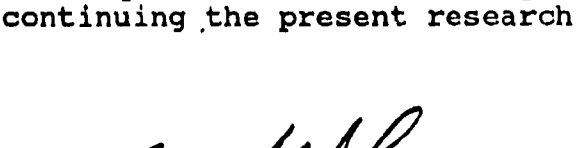
Performance and Training

FOREWORD

Over the past several years, the phenomenon of group cohesion has become increasingly important to the Army. This interest has led to increased research effort in the areas of cohesion and performance. Although there have been many reviews and summaries of the cohesion research, there has been to date no quantitative integration of that body of research. This report describes an effort to apply a meta-analytic approach to the integration of the cohesion-performance literature that employed real world groups and contained empirical data. As such, the report models some innovative techniques for research integration and also provides support for continuing the present research on cohesion and performance.



EDGAR M. JOHNSON
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THE RELATIONSHIP OF GROUP COHESION TO GROUP PERFORMANCE: A RESEARCH INTEGRATION ATTEMPT

EXECUTIVE SUMMARY

Requirement:

The phenomenon of group cohesion is of great interest to the Army since it is viewed as a group characteristic that is to a large extent under the control of the commander and is also positively linked to unit performance. Although much of the cohesion research has involved laboratory studies conducted on small groups organized for the purpose of the research, some studies have involved real world groups such as military units, industrial work groups, and sports teams. The purpose of the present effort was to integrate the research literature investigating the relationship of cohesion and performance in real world groups by using a meta-analytic (quantitative) approach.

Procedure:

A search was made for research reports that met the criteria of real groups, empirical data, and cohesion-performance relationships. The 14 codable documents so identified were coded and the effect sizes (product-moment correlation coefficients) analyzed. If more than one cohesion-performance measure was reported, a study effect size was calculated by averaging the correlations. Tukey's (1977) stem and leaf display (an exploratory data analysis technique) was used to summarize the data. Rosenthal and Rubin's (1982) Binomial Effect Size Display (BESD) was employed to demonstrate the effect of the mean effect size on success rate.

Findings:

The product-moment correlations between cohesion and performance for the 14 studies ranged from -.04 to .90. The median correlation was .36, and the unweighted mean $\bar{r}$ was .41. When study effect sizes were weighted by the number of groups involved, the mean became .33. Rosenthal and Rubin's BESD demonstrated that a correlation of .33 increases success rate (high performance) from 34 percent to 66 percent when cohesion rises from low (below the median) to high (above the median). Assuming that cohesion is related to performance at about this level (correlation of .33), higher levels of cohesion would seem to be very desirable for real world groups such as Army units. However, the results are problematical due to the very small number of codable

studies and the conceptual and methodological problems associated with the cohesion-performance research. Also, the phenomenon may be cyclical in nature, with high performance leading to greater cohesion, as well as higher levels of cohesion enhancing performance.

Utilization of Findings:

The findings reported above provide support for current efforts to enhance performance in Army groups by increasing the cohesion of those groups. The research also models a meta-analytic approach to research integration.

THE RELATIONSHIP OF GROUP COHESION TO GROUP PERFORMANCE: A RESEARCH INTEGRATION ATTEMPT

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The Relationship of Group Cohesion to Group Performance: A Research Integration Attempt[1]

INTRODUCTION

Background

Over the past several years, the phenomenon of group cohesion has become of increasing interest and importance to the Army (Griffith, 1987). Cohesion is viewed as a group characteristic that is, to a large extent, under the control of the commander and also positively linked to unit performance. This renewed interest in cohesion has also led to increased research effort on the topic.

Previous research on cohesion (or "group cohesiveness") has been quite extensive. Most of it has involved laboratory studies of small groups brought together for the purpose of studying the phenomenon and its characteristics. But a number of studies were conducted with "real" groups such as military units, industrial work groups, and sports teams. In some instances, the cohesion studies investigated the performance variable. Sometimes performance was contrived (as for a group given the task of constructing a Tinker Toy-like structure), but sometimes it involved real-world tasks such as building bridges or winning games. Although there have been numerous reviews or summaries of the cohesion research (e.g., Bass, 1981; Cartwright, 1968; Hare, 1976; Ivancevich, Szilzgyi, & Wallace, 1977; Lott & Lott, 1965), there has to date been no quantitative integration of the literature.

During the last decade, research reviewers have made increasing use of quantitative techniques in integrating research. A classic article by Glass (1976) introduced the concept of "meta-analysis"--the analysis of analyses. The meta-analytic approach to research integration calls for the conversion of research results from a set of studies to a common metric. This common metric, or "effect size," can then be combined across studies to derive generalizations about the entire sample of studies. Since the Glass article, many articles and a number of books (Cooper, 1984; Glass, McGaw, & Smith, 1981; Smith, Glass, & Miller, 1980; Hunter, Schmidt, & Jackson, 1982; Light & Pillemer, 1984; Mullen & Rosenthal, 1985; Rosenthal, 1984) have been written on meta-analytic approaches to research integration.

[1]The author wishes to express her appreciation to Dr. Harris Cooper and Dr. Lois Northrop for their helpful comments.

Problem

As noted above, there has been considerable research on cohesion. Yet the precise nature of the relationship of cohesion to performance has not been established. While it is generally accepted that cohesion usually enhances performance, there is some evidence that under certain circumstances cohesion impairs performance (Etzioni, 1975). There is also some concern that groups assembled for the purpose of an experiment may not function similarly to real life groups.[2]

Purpose of the Research

The purpose of this research effort was to integrate the empirical literature on cohesion which involved real work groups in order to explore the relationship between cohesion and performance. The research questions to be answered were:

(1) Is there a relationship between group cohesion and group performance?

(2) If there is a relationship between group cohesion and group performance, what variables moderate this relationship?

A quantitative approach was to be used in the research integration effort in order to illustrate the application of meta-analytic procedures and techniques. The present study is an example of the type of research integration needed in applied psychology (Oliver, in press).

METHOD

Identifying Pertinent Studies

Computer searches were conducted on a variety of relevant databases such as DTIC, ERIC, SOCIAL SCISEARCH, SOCIOLOGICAL ABSTRACTS, and PsychINFO. Previous ARI searches on "cohesion" and "team performance" were updated. Several thousand titles and abstracts were scanned, and promising documents were obtained.

[2]Over the years, there has been spirited debate about "ecological validity." Berkowitz and Donnerstein (1982) have argued it is not necessary to use real people in real world conditions to insure external validity. Gordon, Slade, and Schmitt (1986), however, reviewed 321 studies which involved students and nonstudents under identical conditions and found that comparisons often resulted in significant differences between the two types of subjects.

Relevant review articles were searched for appropriate references, and the reference lists of articles were also inspected for pertinent studies that had not otherwise been identified. The purpose of the search was to identify documents which reported empirical investigations of the relationship between group cohesion and group performance and which involved real groups, not groups assembled for the purpose of the study.

Of 26 research reports which met the above criteria of real groups, empirical data, and cohesion-performance relationships, 14 documents proved to be codable. The remaining documents were uncodable due to data reporting deficiencies.

Coding Procedure

A coding form was developed which included the following variables in addition to the APA-style reference: definition of cohesion, type of cohesion measure, type of sample, total number of subjects, number of groups, number of subjects per group, performance measures, effect sizes for each performance measure, and mean effect size for the study. Table 1 summarizes the coded studies.

Calculation of Effect Sizes

In most cases, the relationship between cohesion and performance was reported as a correlation coefficient, usually Pearson's *r*. Nunnally (1978) has stated that phi, point-biserial *r*, and rho "are all the same" and equivalent to the "regular" product-moment coefficient (p. 132). Thus, in two cases (Goodacre, 1951; Rosen, 1969) in which the rank order correlation was reported, the value for rho was used. One author (Van Zelst, 1952) reported pre-post means and standard deviations which permitted the calculation of Cohen's *d* (Cohen, 1977, p. 21), which was then converted to the corresponding *r* using the formula in Cohen (1977, p. 23). Probability levels for the chi square results of another study (Goodacre, 1953) were transformed into the equivalent *r* using the formula in Glass et al. (1981, p.150).

Data Analysis

The unit of analysis was the study. When more than one effect size was calculated because the researcher had employed multiple performance measures, the unweighted effect sizes were averaged to obtain a mean effect size for the study. In averaging the effect sizes (correlation coefficients), either within or across studies, the *r* to z transformation was not used. Glass et al. (1981) do not consider this procedure necessary, nor do they recommend the alternative procedure of squaring the coefficients and computing the square root of the average (of the squared coefficients).

Table 1

Summary of Studies Investigating Cohesion-Performance Relationship in Real World Groups

Reference	Sample	Cohesion measure	Performance measure	Findings	Comments
Blades, J.W. (1986)	Military cooks & mess stewards (49 groups)	10-item semantic differential (Fiedler, 1967) self-report	12-item mess hall ratings by brigade & post food service officers	r = .69 (p < .025) (2 groups) for high member ability & motivation; n.s. for other levels: r's for other cells = .09 (10 groups) .07 (13 groups) .52 (10 groups) mean r = .24	Correlation between group cohesion & group performance as function of member ability & motivation. Other variables: leadership style; leader/member intelligence; leader/member ability (job skill).
Downey, Duffy, & Shiflett (1975)	Men in 23 military detachments N = 275	6-item Group Cohesion scale of "Post-FTX Questionnaire" (PFQ). Detachment members were respondents.	17-item Group Performance scale of PFQ	Correlation between Group Cohesion & Group Performance scales r = .37	PFQ administered post-exercise. Factor analysis used to derive scales. Other variables: job satisfaction, job effectiveness morale, individual performance effort, mission effectiveness, espirit.
Goodacre, D.M. III (1951)	Military scout squads of reconnaissance platoons (12 groups)	"Sociometric Test" 8-item instrument asking whom respondent would choose & not choose in different situations	Ratings of "Combat behavior" in 12 tactical situations on "standardized rating forms" by Western Reserve Univ. personnel & "the military"	rho = .77 between cohesion total score & performance subscores: rho = .62 (garrison) rho = .78 (social) rho = .79 (tactical) mean rho = .73	Rank order correlation between cohesion & performance (Guilford says rho go[illegible]timate of r for small samples). Other variables: none.

Reference	Sample	Cohesion measure	Performance measure	Findings	Comments
Goodacre, D.M. III (1953)	Army 9-man rifle squads (26 groups) N = 234	3 "near-sociometric questions" of "Intimacy" scale of interviews schedule; interviews conducted by persons with "at least M.A. level training in psychology"	Ratings of performance on "6-hour blank firing problem" by 2 umpires following 63 randomly selected rifle squads	Chi square results (Intimacy items): (a) = 2.03 (p =.20-.10) (b) = 5.07 (p =.05-.02) (c) = 1.47 (p =.30-.20) (a) $\underline{r}$ = .28 (b) $\underline{r}$ = .44 (c) $\underline{r}$ = .24 mean $\underline{r}$ = .32	Differences in cohesion between 13 high performance & 13 low performance squads. Other variables: stability (turnover); stratification & control; hedonic tone; & viscidity.
Griffith (1987)	Army companies (43 groups) N = 8869	WRAIR self-report instrument with 7 cohesion scales	Percent of soldiers in 3 marksmanship categories (training performance)	$\underline{r}$= .18 for Expert $\underline{r}$= -.13 for Sharpshooter $\underline{r}$= -.17 for Marksman mean $\underline{r}$ = -.04	Focus of study on unit vs. individual-replacement units, although data presented on correlation between cohesion & marksmanship for individuals. (Data for many companies missing or unreported.) Other variables: psychological wellbeing, life & Army satisfaction, social support.

Reference	Sample	Cohesion measure	Performance measure	Findings	Comments
Hemphill & Sechrest (1952)	B-29 air crews (94 groups)	Sociometric nomination re whom wanted on crew yielded index of "on-crew" vs. "off-crew"	Bombing accuracy of crews as judged by 1-5 "qualified raters"	r= .36 for correlation between sociometric and bombing data	Reliability of sociometric data = .91 superior's ratings of crew accurancy =.30-.70; but reliability of bombing accuracy data not significantly different from .00. Other variables: none.
Keller (1987)	R&D professionals in 32 project groups N = 221	Seashore's (1954) 5-item scale administered to group members	(1) Project quality (2) Budget/schedule performance rated by managers and group members	(1) r= .44 member response r= .47 management response r= .51 management response 1 year later (2) r= .40 member response 1 year later r= .32 member response 1 year later r= .36 management response 1 year later mean r = .42	Other variables: group size, physical distance of members, member tenure, type of R&D quality of equipment, education, job satisfaction, self-esteem, technical influence, innovative orientation.
Manning & Trotter (1980)	Battalions (10 battalions inferred from table) N = 370	IG team member rating on responses to questions asked of 37 persons in battalion (S-1, 2 company commanders, first sergeants, etc.	8 "traditional" measures of battalion performance (ARTEP, AGI, SQT, PT, ORT, AD, UCMJ, REUPs)	r= .79 for correlation of cohesion and combined performance measures	Correlation of cohesion with individual measures ranged from .09 -.84, but combination yielded r of .79. Other variables: none.

Reference	Sample	Cohesion measure	Performance measure	Findings	Comments
Melnick & Chemers (1974)	College Intramural basketball teams (21 groups) N = 5-101 group	4 items from Martens & Peterson (1971) instrument (9-point scale)	Number of games won	Correlation of cohesion items with percent of games won/lost: (1) $\underline{r}$ = .22 (2) $\underline{r}$ = .17 (3) $\underline{r}$ = .00 (4) $\underline{r}$ = .10 mean $\underline{r}$ = .12	As "real" groups, some teams may have been in existence as little as 2 weeks.
Moos (1986)	Basic Combat Training companies comprising enlisted people (8 groups) N = 1432	Peer Cohesion scale of Military Environment Inventory (MEI)	Test Performance index (companies rank ordered on firing, physical training, & graded test scores; scores summed.)	Correlation of Peer Cohesion scale with Test Performance $\underline{r}$ = .58	Peer cohesion 1 of 3 "Relationship" dimensions. Others are "Involvment" (of members in functions of unit) and "Officer Support." Other variables: mood disturbance (anxiety, hostility, insecurity), sick call, positive perceptions and expectations, reenlistments.
Nelson & Berry (1968)	Marine platoons (randomly sampled from 191 platoons) (24 groups) N = 1536	"Peer nominations of friendship" (5 choices) entered into "cohesion index"	(1) Physical proficiency test (2) Rifle qualifications test (3) Satisfactory completion 2 years service (4) Platoon membership stability	Correlation of cohesion index with performance measures (1) = .00 (2) = .00 (3) = .00 (4) = .41 mean rho = .10	Used rho. Individual performance measures. Measures 1-3 were reported as "not significant." Effect sizes estimated as 0 in these cases. Other variables: demographic variables (age, geographical region, education), stability (turnover), time.

Reference	Sample	Cohesion measure	Performance measure	Findings	Comments
Rosen (1969)	Upholstery workers in furniture manufacturing plant (8 groups, 8-10 workers per group); highly stable groups N = 73	"Tailor-made" sociometric choices of preferred co-workers (3 of 10 choices	Percent of base rate achieved by each worker (mean for group)	Correlation of cohesion with productivity rho = .69	Incentive plan in operation with workers paid on percent of base rate achieved. One group eliminated from analyses because 3 of 5 personnel changes occurred in that group. Other variables: foreman preference, status consensus on foreman, perceptions of foreman characteristics, money motive, production scheduling, product mix.
Schriesham (1980)	Low- and middle-managerial clerical employees from 43 work groups in a public utility N = 393	Stogdill's (1965) 5-item cohesion measure (self report)	Mott's (1972) 8-item measure of unit performance (self report)	Correlation of cohesion and performance measure $r = .24$	Tested relationship between leader structuring behavior and subordinate productivity as function of cohesion, but reported zero-order correlations among scales. Other variables: leader initiating structure, leader consideration, subordinate role clarity, satisfaction with supervision.

Reference	Sample	Cohesion measure	Performance measure	Findings	Comments
Van Zelst (1952)	Carpenters and bricklayers in dyads or 4-person teams (Number of groups not clearly specified) N = 74	Sociometric choices of 3 co-workers as work partner	(1) Turnover (2) Labor cost (3) Materials cost for all work groups	Effect sizes (1) $\underline{d}$ = 3.79 (2) $\underline{d}$ = 7.48 (3) $\underline{d}$ = 3.57 (1) $\underline{r}$ = .86 (2) $\underline{r}$ = .97 (3) $\underline{r}$ = .87 mean $\underline{r}$ = .90	Cohen's $\underline{d}$ (Cohen, 1977, p. 21) calculated by dividing difference between pretest mean and posttest mean by within-groups standard deviation and then transforming $\underline{d}$ into equivalent $\underline{r}$ (Glass et al., 1981, p. 150). Other variables: none.

RESULTS

Table 1 contains a summary of the 14 coded studies. For each study, the sample, the cohesion measure, and the performance measures are described. The "Findings" column contains data on the cohesion-performance relationship. If more than one performance measure was involved, the effect size is shown for each measure. The mean effect size for each study is also reported in this column. Other information of interest is given under "Comments," and variables other than cohesion and performance are noted here.

The stem and leaf display in Table 2 illustrates the use of this exploratory data analysis technique to summarize data (Tukey, 1977). In the table, the intervals to the left of the vertical bar serve as "the stem," and the correlation coefficients to the right are the "leaves".[3] The display provides a visual picture of the distribution of the data. From such a display, one can observe where the values seem to be centered, how widely the values are spread, if the data are skewed in one direction or the other, if the data separate into groups, if certain values or ranges of values are unexpectedly overrepresented (or underrepresented), etc.

[3]Normally, the stem is the first digit in the coefficient (e.g., .7, and the leaves the second (e.g., 3, 9). With the small number of data points here, however, it was more meaningful to group the numbers into intervals of .2 and to display the entire coefficient in the leaf position.

Table 2

Stem and Leaf Display of Cohesion-Performance Correlations

Interval	Study $\underline{r}$ (mean)	Summary statistics	
.8-.9	.9	Maximum $\underline{r}$	.90
.6-.7	.69 .73 .79	Third quartile (Q_3)	.69
.4-.5	.42 .58	Median (Q_2)	.36
.2-.3	.24 .24 .32 .36 .37	First quartile (Q_1)	.24
Ø-.1	.1Ø .12	Minimum $\underline{r}$	-.Ø4
(-)	.Ø4		
		Mean ($\underline{r}$)	.42
		SD_r	.28
		Weighted mean	.32

A scan of the display indicates that the study effect sizes (correlation coefficients) appear to be more or less normally distributed with the lower values clustered somewhat more closely than the higher values. The summary statistics found on the right of the table confirm these observations. The values range from -.Ø4 to .9Ø, with a median of .365. The first quartile value is .24, and the third quartile value is .69. Also included in the summary statistics are the unweighted mean effect size (.42), its standard deviation (.28), and the weighted mean of the study effect sizes (.32). (The weighted mean was obtained by averaging the study effect sizes after each had been weighted by the number of groups in the study.)

In addition to the variables of cohesion and performance, other variables were sometimes investigated. These variables included leadership styles, psychological traits, attitudes, group characteristics, and demographic data. No related variable was reported in a sufficient number of research investigations to warrant quantification.

DISCUSSION

This research integration attempt did not encompass enough studies to lead to unequivocal conclusions concerning the relationship between cohesion and performance, nor did it allow an exploration of the quantitative relationship of moderator variables to the cohesion-performance main effect. This research effort did, however, illustrate the procedure of quantitative research integration.

The effect sizes calculated for the results of the studies included in this research integration were product moment correlations. The procedures described above demonstrated how a researcher can convert different types of statistics to a common metric that can be combined within and across studies. The effect sizes are data which can be analyzed using essentially the same techniques one would use for data from primary sources. The analyses conducted on this data set were simple descriptive statistics: measures of central tendency and dispersion. Because of the limited number of studies, additional procedures such as testing for homogeneity (Hedges & Olkin, 1985; Rosenthal, 1984) or correcting for sampling error (Hunter, et al., 1982) were not followed.

The approach used here also demonstrated how one may obtain somewhat different results by using either weighted or unweighted effect sizes. The principle underlying the weighting of effect sizes is that as the size of the sample increases, sampling error decreases. Therefore, it is argued, one should weight more heavily those studies which use larger samples. Following the advice of Wolf (1986), both weighted and unweighted values are reported here.

Although .42 (or .32) seems a modest correlation, Cohen (1977) has suggested that correlations of .3 are "medium" effect sizes while those of .5 or greater are "large" effect sizes. Cohen's guidelines are arbitrary, but they are often quoted and do provide a measuring stick of sorts. Another comparison which can be made is with the results of the meta-analysis conducted by Spector (1986). Spector investigated the relationship between employee-perceived control (autonomy and participation) and various outcome variables (e.g., job satisfaction, commitment, performance, and turnover). The effect sizes reported were the mean correlation weighted by sample size and the mean correlation adjusted for attenuation in both control and (where possible) outcome variables. The data reported for the 24 samples involving the control-performance relationship were: mean $\underline{r}$ = .20; adjusted $\underline{r}$ = .25. While these correlations are lower than those found for the cohesion-performance relationship in this research, the results are not dissimilar.

Another way of interpreting a correlation coefficient is by using the binomial effect size display (BESD) developed by Rosenthal and Rubin (1982). (Also see Rosenthal, 1984, pp. 129-^R

132.) The BESD answers the question of what the effect is of a predictor variable (selection device, organizational intervention, treatment, and the like) on the success rate (e.g., retention rate, improvement rate, survival rate) attributable to the predictor. For illustrative purposes, it is assumed that increasing cohesion enhances performance.

To demonstrate the BESD procedure, the weighted mean correlation of .32 is used. Following the example of Wolf (1986, p. 32), cohesion and performance are classified into "high" and "low" categories by a median split.

Table 3

Binomial Effect Size Display (BESD) for Cohesion-Performance Product-Moment Correlation of .32

	Performance		
Cohesion	High	Low	Total
Above median level	66	34	100
Below median level	34	66	100
Total	100	100	200

Table 3 depicts the effect of a correlation of .32 on success rate (high performance). As can be seen in the table, 66 percent of the high performing units would be above the median and only 34 percent below the median on cohesion. This result suggests that changing the cohesion level from low to high is associated with increasing the number of high performers from about 34 to 66 percent.[4] Assuming that cohesion is truly related to performance at about this level, higher levels of cohesion would seem to be definitely desirable for real world groups such as Army units.

To the extent that this small sample is representative of the population of empirical studies based on real groups, a moderately strong positive relationship between cohesion and performance appears to exist. However, the correlational data do not permit the inference of causality. Although it is generally accepted that higher levels of cohesion lead to more effective performance, it may be that the reverse is also true--i.e., higher performance enhances group cohesion. Winning teams may be

[4]Using the less conservative value of .42 (unweighted mean correlation), the success rate would rise from 29 to 71 percent.

cohesive because they win, rather than they win because they are cohesive. Or, perhaps, a cyclical relationship is involved, with high levels of cohesion leading to more effective performance which in turn increases group cohesion. It should also be emphasized that this research focused only on the simple relationship of cohesion and performance. Since real world settings are complex, this relationship is undoubtedly influenced by a number of other variables. Before drawing final conclusions about the relationship of cohesion and performance, it would be important to identify those moderator variables and delineate their separate and joint effects on the cohesion-performance link.

CONCLUDING REMARKS

It is emphasized that the set of studies upon which this research integration effort is based is very small. In addition, there are a number of conceptual and methodological problems associated with the cohesion-performance research which make the results of this analysis problematical. These problems are discussed elsewhere (Oliver, 1987). However, the research reported here does illustrate the use of exploratory data analysis and a quantitative approach to research integration. The results also suggest that there is a positive relationship between cohesion and performance that may have practical implications for Army units and other real world groups.

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APPENDIX A

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